Growth of europium monoxide thin films by MBE

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Recent studies have highlighted the great interest in applying EuO thin films directly grown on Silicon in spintronic devices, as a spin polarization of mobile electrons of nearly 100% have been predicted along with a polarization exceeding 90% in epitaxial EuO films. Furthermore, the ferromagnetic semiconductor EuO is the only binary oxide that has been epitaxially grown on silicon in a thermodynamically stable form and thus the only that can be used for spin filtering applications, so far. As EuO is a highly reactive oxide which is extremely unstable in ambient conditions, and readily forms higher oxides, its growth from the vapor phase is very challenging and has only been achieved by a few groups worldwide [1-4]. In the present work, we have studied and optimized the experimental conditions (growth rate, oxygen partial pressure and substrate temperature) for growing EuO thin films on silicon (001) and YSZ (100) by using the MBE technique. Structural and magnetic characterizations have been performed confirming the growth of the monoxide films even when deposited at room temperature. Although SQUID measurements, with saturation magnetizations of 6.2 μB per Eu atom near the theoretical prediction of 7 μB and a coercive field of 220±10 Oe, seemed to indicate an epitaxial growth of the optimized layers, X-ray analysis showed that EuO film were polycrystalline but highly in-plane textured.

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References